PRODUCTIVITY AND COSTS, WITH SPECIAL REFERENCE TO THE FELLING BENCH

T. G. H. BANKES

Woods and Forests Department, G.P.O. Box 1604, Adelaide, South Australia 5001

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ABSTRACT

Increases in productivity in the felling component of wood harvesting in **Pinus radiata** D. Don plantations in the south-east region of South Australia during the period 1975–81 provide evidence that the introduction of fully mechanised felling systems can be delayed during the next decade. Reasons for the gains achieved include productivity aids such as the felling bench used in first thinnings. Continuing increases in productivity will be essential to maintain existing motor-manual systems in harvesting operations in South Australia.

INTRODUCTION

It is appropriate to outline briefly some of the many, frequently complementary changes that have occurred in logging in the south-east region of South Australia during the past decade. These include:

(1) Phasing in of forwarders and skidders to replace crane trucks from 1974 to 1977;
(2) Replacement of short pulp log billets with long pulp logs;
(3) Formation of a Logging Industry Training Team in 1972 and commencement of formalised feller training courses in 1977;
(4) Re-organisation by the logging industry of planning and development in harvesting;
(5) Increasing awareness of the importance of accident prevention as it affects costs and productivity.

Such changes have had a significant impact on productivity in the processing of the standing tree. Trends in productivity movements are ultimately reflected in the landed cost of raw material at a processing plant and the return, generally known as royalty or stumpage, to the forest owner. This paper concentrates on the felling and processing component of the landed cost.

Analysing Productivity Changes

Production changes can be identified by analysis of longer term trends, coupled with periodic detailed studies of particular components of a system. Such detailed studies can be costly and there is always the risk that the level or method of sampling may be insufficient to produce a useful result. Frequently these studies produce information that is interesting academically but of limited value to the manager. Their

greatest value lies in identifying the benefits and costs associated with options within a manager's capacity to implement. On the other hand, direct productivity studies within particular operations involve a number of complex and inter-related variables which are not easy to isolate, and this makes comparison between operations quite difficult. Some of these interlocking variables are tree size and merchantable stem volume, forest conditions and constraints, tree form and characteristics, wood presentation requirements, skills and experience of the feller, training and mechanical aids available, weather conditions, economic climate of the industry, feller relationships at home and at work, self-motivation of the individual.

Because there is such variability this paper takes the broad view, avoiding too detailed a scrutiny of individual operations.

GENERAL TRENDS IN PRODUCTIVITY

Analysis of roundwood volumes produced by a group of nine logging contractors in South Australia shows considerable productivity gains since 1975 (Table 1, Fig. 1). The average number of fellers in the period 1973–76 dropped by 35% whilst total volumes logged showed some marginal increases. The industry then entered a period of consolidation (1977–79) before volumes increased during the 2 years ending 30 June

TABLE 1—Roundwood volumes produced by fellers working for nine contractors

	1975	1976	1977	1978	1979	1980	1981
No. fellers as at 30 June	202	173	131	133	127	125	120
Roundwood volume (m^3)	590 985	591 589	616 165	609 612	608 162	655 670	730 328

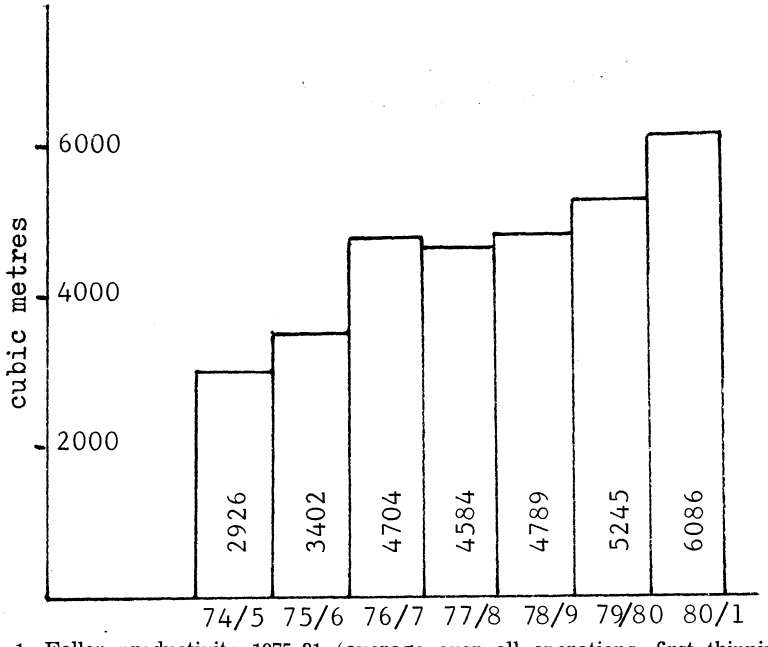

FIG. 1—Feller productivity 1975–81 (average over all operations, first thinning to clearfelling)

1981. These roundwood volumes include the whole range of tree sizes from 0.15 m^3 to more than 3.0 m^3 merchantable volume per tree.

The rapid drop in feller numbers in the early period was related directly to changes in the extraction and loading methods being employed. Thus over a 7-year period feller productivity rose from an average of 2926 m^3/man per year to a level of 6086 m^3, an increase of 108%. The initial increase resulted from a change in work method as crane trucks were replaced by forwarders and skidders. The subsequent rise from 4700 m^3 to over 6000 m^3 can be attributed to:

(1) Increased use of roundwood by the industry;
(2) The vigour applied in the logging industry to training and accident prevention measures, through the Woods and Forests Department;
(3) Departmental re-organisation to create a Division for improving harvesting efficiency and effectiveness.

N. A. Kuhn (Assistant Logging Manager, Woods and Forests Department) analysed production in several different first-thinning operations and related the changes to groups of fellers producing "normal" production ranges per man-day (Fig. 2). Kuhn's findings, which are necessarily broad in concept, suggest a steady increase in feller productivity levels in motor-manual first-thinning operations.

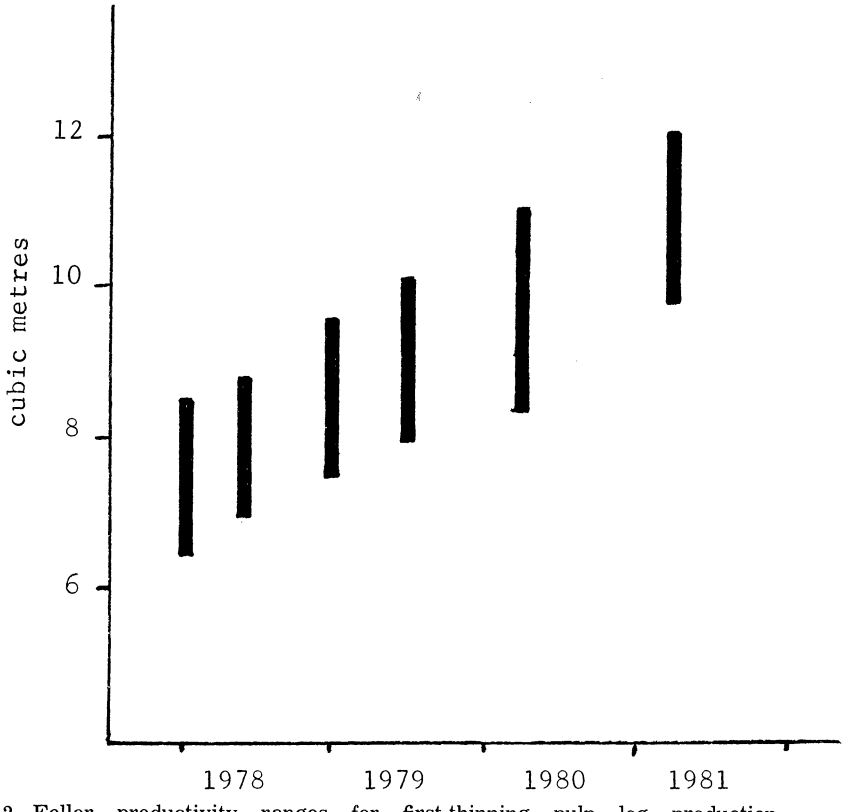

FIG. 2—Feller productivity ranges for first-thinning pulp log production (m^3/man-day)

IDENTIFYING SPECIFIC FELLER PRODUCTIVITY MOVEMENTS

A number of fellers were selected in 1977 as representing groups of fellers with different productivity levels in first-thinning operations. Since then records of volumes (Fig. 3) produced and earning capacities have been kept for the individuals selected. By chance these fellers went through differing training programmes (Table 2).

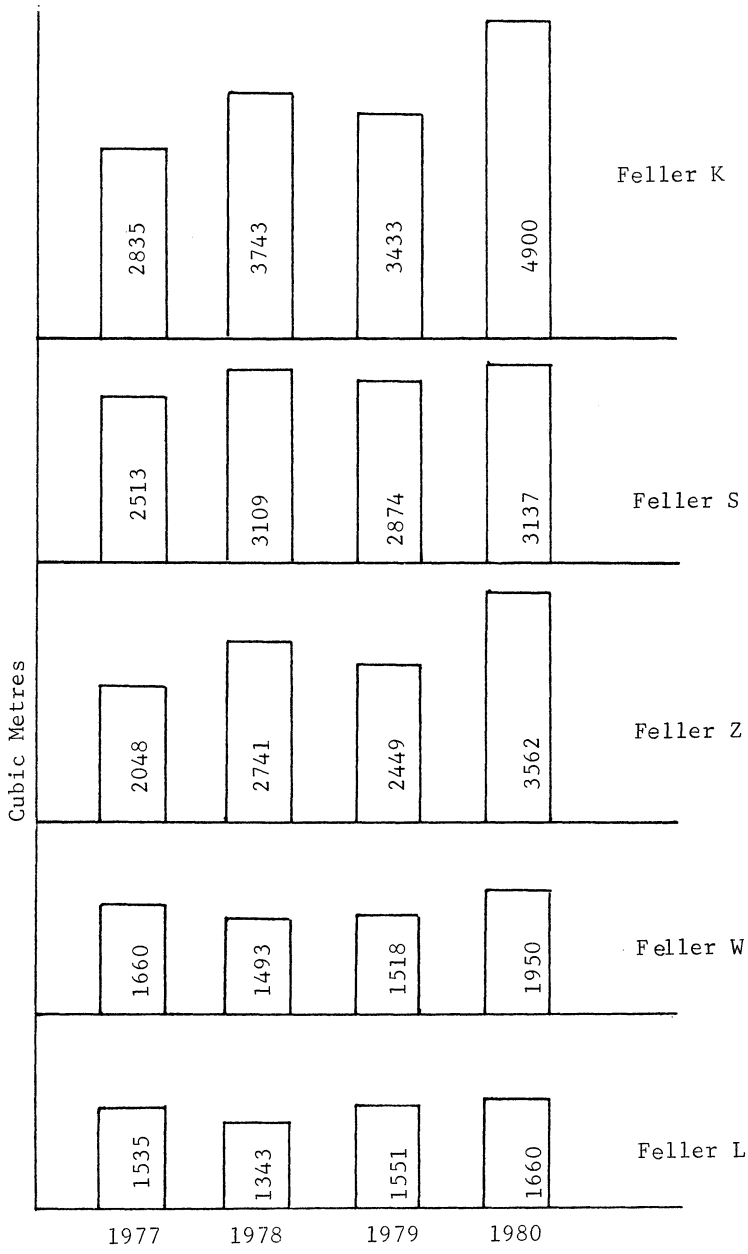

FIG. 3—Individual feller productivity per annum in first thinnings

TABLE 2—Training and productivity of five fellers

Training course	Feller	Date of course	Productivity increase since 1977
Specific formalised 3-week training course	Z	April '79	+74%
	W	Aug '78	+15%
Less formalised on-job training over 2 weeks	K	1979	+73%
	S	1979	+25%
Negligible training	L	—	+8%

One can only draw generalised conclusions but it appears that:

(a) Significant gains can be achieved with production-orientated training schemes;

(b) These gains are very significant with high-producing fellers.

The industry is likely to derive greater benefit by re-training its higher producers than by trying to lift the productivity of lower producers to acceptable levels, although it can be difficult for both the instructor and manager to convince the elite that they will benefit most from a re-training programme. In training programmes of this nature emphasis is placed on methods tailored to the individual and systems which favour productivity and accident prevention.

Dowling Felling Bench as a Productivity Aid

One of the productivity aids used consistently by fellers in first-thinning operations in the south-east region is the Dowling Felling Bench. Developed by Brian Dowling through the Logging Industry Training Team, the felling bench is a steel-fabricated trestle weighing approximately 25 kg. Trees are felled across the bench, enabling trimming and wood presentation to be carried out with minimal bending and lifting (Fig. 4). Its advantages are in achieving higher productivity at lower accident potential levels.

It is difficult to asses the productivity gain attributable directly to the use of this bench in felling operations as it cannot be separated from the system and training as a whole. To make adequate use of a felling bench fellers need specific skills, particularly in directional felling, trimming, and presentation. Such skills are rarely sufficiently developed in a feller prior to training in use of the bench. Consequently, productivity gains associated with the introduction of a felling bench are complemented by an increase in skill levels in all techniques associated with felling, delimbing, and bucking of the tree. Analysis of the two fellers previously identified as being above-average producers with high productivity increases over a 4-year period, shows the combined effect of training and introduction to the felling bench (Fig. 5).

ECONOMIC BENEFITS OF PRODUCTIVITY GAINS

Ultimately production patterns are reflected in the market place in the form of wood cost. In first-thinning operations the felling portion of total landed cost can be as high as 35% in the south-east region. As complete landed-cost summaries are

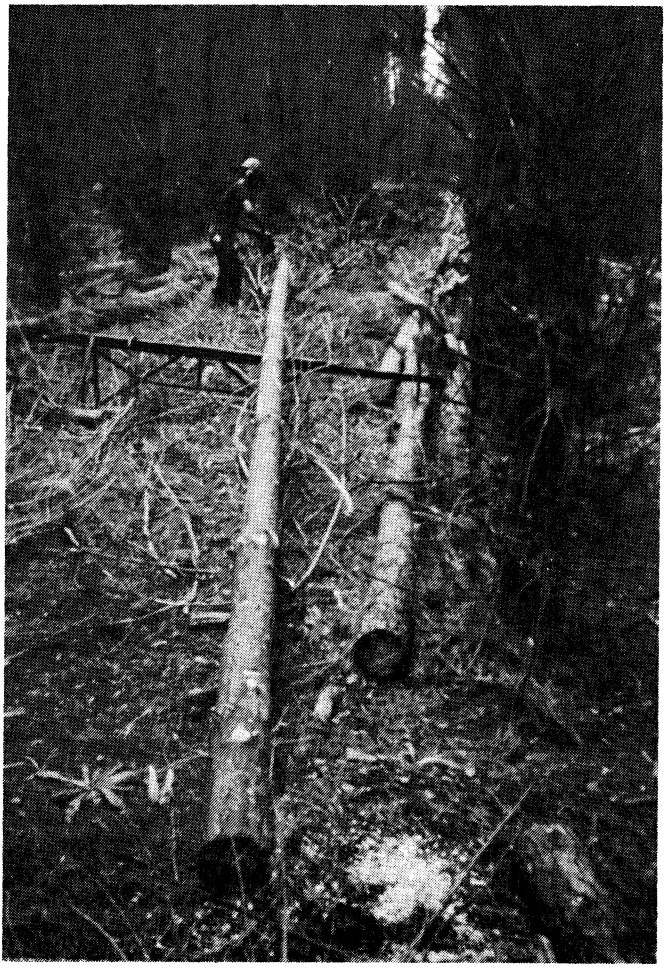

FIG. 4—Felled tree across felling bench being trimmed before sliding into wood zone

maintained on a quarterly basis for pulp log deliveries to pulpmills in South Australia, the felling portion of total landed costs can be compared with the Consumer Price Index (C.P.I.) movements for the State (Fig. 6). Cost increases since mid-1977 have tended to move significantly below C.P.I. increases. While compounded C.P.I. increased by 57.5% between June 1976 and June 1981, the felling component of harvesting costs rose by 39.2%. If felling rates were tied to C.P.I. increases since 1976 the average cost (including workmen's compensation, etc.) would be A$10.27/m^3 by June 1981. Actual average for June quarter 1981 was A$9.06, and moving average for 12 months ending June 1981 was A$8.73.

When production of a unit operating in first thinnings at an annual level of approximately 80 000 m^3 is compared with felling cost increases and C.P.I. for South Australia (Table 3), it is apparent that felling rates have recently been moving at

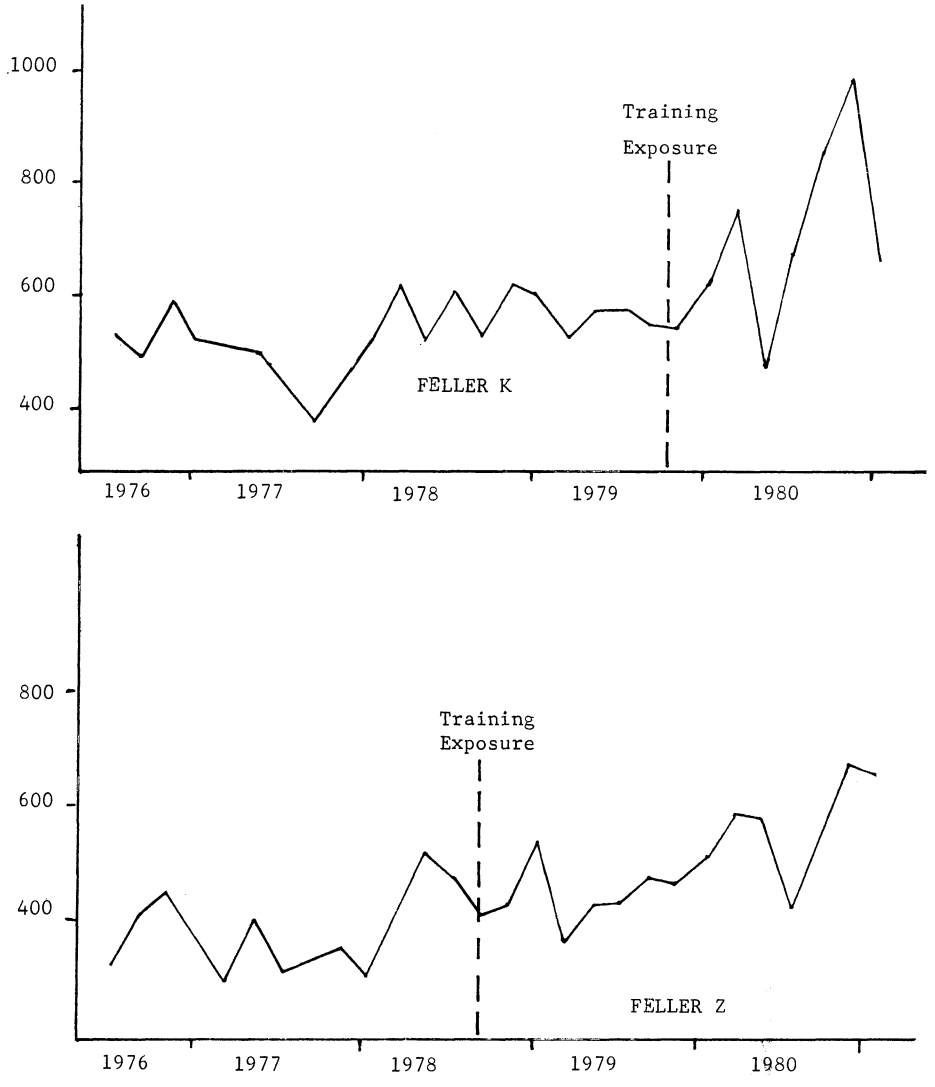

FIG. 5—Impact of training and use of felling bench on individual feller productivity (m^3) at 2-monthly periods

somewhat less than 50% of C.P.I. The cost of felling in first thinnings rose during 1979 and 1980 by 9.0%, while individual feller earnings notionally increased by nearly 40%. The conclusion derived from this analysis is that labour has gained substantial benefits from productivity increases during the past 3 years whilst industry benefits have been substantially less. However some factors tend to overstate the increase in individual feller's actual earnings:

(a) Reducing feller numbers results in attrition of lower producers;

(b) Volume production increases in the system motivate individuals to work longer hours.

FIG. 6—Actual felling costs **v.** Consumer Price Index

TABLE 3—Production, felling price, and C.P.I. increases

Year	Average production per feller (m^3/yr)	Production increase (%)	Average felling price increase (%)	C.P.I. increase (%)
1978	1653			
1979	1860	+12.5	+4.2	+8.2
1980	2122	+14.0	+4.6	+11.0

DISCUSSION

Over the past few years there have been production gains at both industry and individual levels in the south-east region of South Australia. Their consistency, from analysis of different data bases, indicates that these changes in productivity are significant in that:

(a) Material productivity increases have been substantial;

(b) The sharing of these benefits to date appears to have favoured the individual rather than the wood purchaser.

Productivity and labour costs are essential ingredients in creating and maintaining any competitive advantages in roundwood harvesting but, provided suitable labour is available, motor-manual systems can still compete with fully mechanised alternatives. Motor-manual techniques are well developed and established: fully mechanised systems are still relatively crude and are dependent, primarily, on high-capital-cost imported machinery and thus at the mercy of international exchange rates, import duties, and economic factors in manufacturing countries. A change towards mechanised systems is

probably inevitable during the next decade, but the rate of change will be reliant upon relative costs. In fully mechanised systems capital cost is directly reflected in 50% of the cost, with labour less than 25%. In motor-manual systems labour is over 80% of the cost and capital 5%. Thus the equation comparing the labour and capital costs of each system will determine the speed of the swing away from motor-manual techniques.

This places the onus on both management and skilled fellers to accept responsibility for charting their future together in the logging industry. The recent cessation of wage indexation should assist in providing the industrial climate that acknowledges present and future productivity gains and therefore the negotiation of fair and equitable distribution of the advantages associated with such productivity rises.

In the long run, any change to full mechanisation should be viewed as a further improvement in felling aids, similar to the revolution that took place with the introduction of the chainsaw two decades ago.